DOCUMENT RESUME

ED 059 844 RE 004 018

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TITLE Developmental Processes and Reading Processes: Invalid Inferences from the Former to the Latter.
PUB DATE Dec 71
NOTE 19p.; Paper presented at the National Reading Conference, Tampa, Fla., Dec. 1971
AVAILABLE FROM National Reading Conference, Inc., Marquette University, 1217 W. Wisconsin Ave., Milwaukee, Wis. 53233

EDRS PRICE MF-$0.65 HC Not Available from EDRS.
DESCRIPTORS *Cognitive Development; Cognitive Processes; *Developmental Psychology; Intellectual Development; Language Development; *Literature Reviews; Motivation; Perceptual Development; *Psycholinguistics; *Reading Processes

ABSTRACT

The author reviews findings in perception, cognition, psycholinguistics, and motivation, concentrating on the development of these processes in the nonreading and beginning reading child rather than in the mature processes of a skilled reader. She offers the following conclusions: (1) Research in perception suggests that there are developmental aspects which affect abilities at different ages. (2) Attempts to trace the development of cognition have resulted in conflicting conclusions based on equally conflicting theories. (3) Development of language abilities, once thought to occur quite early, now appears to extend toward adolescence, and when related to reading must be evaluated in light of social, political, and dialectal contexts, and (4) Attempts to describe theories of motivation must also take social and cultural factors into account. In summary, the author argues that educators must consider the findings in other fields, but must scrutinize them carefully before adopting them to reading. A bibliography is included. (MS)

ED 059844

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DEVELOPMENTAL PROCESSES AND READING PROCESSES

Invalid Inferences from the Former to the Latter

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INTRODUCTION

Most educators believe that, while teaching is an art, there is a body of established knowledge which constitutes a science of education. The basic content of this science, however, seems to be somewhat difficult to define. One can, of course, make analyses of teacher behavior, or conduct field studies comparing the consequences of organizational, or curricular intervention. Such enterprises constitute the bulk of doctoral dissertations and faculty research emanating from our graduate schools of education. Some sciences, especially those which employ so-called "hard data", tend to look down on these kinds of activities as imprecise, lacking objectivity and,

in general, barely meriting the label "scientific."

People in education have another function or responsibility, which is perhaps no more objective, but certainly just as difficult as the task of instilling rigor into educational research. I am referring to the task of keeping abreast with developments in the sciences (not to mention social and political events which may also have profound effects on education but are not under consideration here) in order to determine how these developments impinge, or should impinge, on our educational beliefs and practices. Having determined the relevancy of a particular field to education, the educational expert has the following tasks: a) He must assess the validity and relevance of findings from a particular scientific discipline. Since he is unlikely to be an expert in the field (and is certainly not going to be an expert in all of them), and since experts in the field frequently disagree about these matters, the educator finds himself in a role rather like that of a congressman in committee. He must weigh the various testimonies, and draw his own conclusions. b) Then he must attempt to synthesize, or at least balance the inputs from the different disciplines, to discover whether they are at best congruent, at worst contradictory, but more likely incomplete, piecemeal, and limited in perspective, so that they appear unrelated and incapable of synthesis. c) Next, from the above information he must draw valid interpretations concerning the implications of these findings for educational theory. d) Finally, he must consider the most effective ways to impelement the conclusions he has drawn in the practical setting of the schools. The educator's task has been compared to that of the juggler who must keep many balls in the air at the same time, but for the juggler all balls are equal in appearance, weight, and value. The educator has the additional problem of determining which balls to use, and the relative worth of those he chooses.

I believe that the processes of weighing, synthesizing, and interpreting the many and varied inputs we in education receive from the sciences (again, I am omitting, without discounting, the inputs from social and political sources to which education must constantly lend a listening ear), are extraordinarily difficult, and that the recurring phenomenon known as the "bandwagon effect" may be attributable, at least in part, to this difficulty. Hence we find a tendency among educators to latch on to the findings of some biologist, psychiatrist, or sociologist, and to elevate his pronouncements to the status of a cult, especially if they happen to be in line with their own educational philosophy. A psychologist speaks, and programmed instruction is hailed as an innovation which will change the face of education. A sociologist speaks, and we may well find outselves "deschooling society" and issuing educredit cards in the maternity ward.

It is important, of course, that education remain an open system capable of receiving and using data from the sciences, but as the discipline where synthesis and evaluation of the input must also take place, education has the responsibility of maintaining perspective and of having the strength to withstand scientific incursions which are excessive or unduly limited in their perspective. This may sound conservative, and many educators are afraid of being thought reactionary, out-of-date, or apathetic. We should indeed be open, flexible, and innovative, we should welcome an interdisciplinary approach to the problems of education, but we should be on guard against being subject to every wind that blows from every quarter of the academic globe.

My introductory remarks have been couched in terms of education in general but they apply with equal force to reading. For many years, reading has been the

exclusive province of the education profession, and its career both in research and practice, has followed the ups-and-downs of education. For example, during an era of progressive education, the tendency was to delay the teaching of reading, and to use introductory methods which placed emphasis on units of meaning, such as the whole word or phrase, whereas the no-nonsense, back-to-basics philosophy (e.g. the Rafferty "Education in Depth" approach) called for early and specific training which would give children the "tools" -- usually phonics training; the research of this era is concerned largely with the efficacy of Method X versus Method Y. Similarly a period which empahsized the education of the "whole child" saw the ascendancy of the maturation hypothesis linking reading age with such physiological measures as skeletal age, dental age, etc. as well as psychological measures such as mental age (27).

Like education itself, reading is today the focus of interdisciplinary interest and effort. Personally, I welcome this expansion, this opening of windows to let more sunshine in. Just let us be careful that, if our position happens to be near one window, we are not blinded by the light from that particular window, so that we cannot see the view from other windows. In this paper, I have attempted to take some of the most recent knowledge from other disciplines notably psychology and linguistics, and to use them, not to put the "whole child" together again, since I feel this may be premature, but to achieve in some measure the kind of balance I have alluded to above. I will discuss briefly some findings in perception, cognition, psycholinguistics, and finally motivation. In each case, the development of these processes in the non-reading child will be the focus of consideration, rather than the mature processes of the skilled reader.

PERCEPTION

We may accept at the outset Haber's (17) view, which is shared by many other researchers, that "sensation, perception, memory, and thought must be considered on a continuum of cognitive activity. They are mutually interdependent and cannot be separated except by arbitrary rules of momentary expediency" (p. 1). It appears that all processes on the continuum are geared to the single objective of reducing the uncertainty experienced by the organism in confronting both his inner and outer world. While recognizing the continuum, psychologists still find the terms perception, cognition, etc. useful.

There are many exciting developments in the field of perception, and we can refer to only a few of them. Infant perception has been studied intensively, and we now have evidence that the infant's world is not the booming, buzzing confusion hypothesized by William James, but is characterized even as early as 16 weeks, by pattern discrimination, object permanence, size constancy, and depth perception. Fantz (13) and Miranda (23) at Case Western Reserve University's Perceptual Development Laboratory have found that infants show visual preference for complex, brightly patterned or colored, moving stimuli. In 1961, Walk and Gibson (34) developed the simulation of a "visual cliff" by means of a divided patterned surface. Subsequent research on a variety of species has shown that all except flying and swimming animals avoid the "cliff edge" at a very young age, e.g. at three days of age for monkeys (29). Infants cannot be tested on this situation until they begin to crawl, but Walk (33) found that 90% of infants between 6 and 16 months make avoidance responses.

Other areas of study with infants are the perception of size constancy over distance, linking of visual and tactual cues in perception of objects, and the relationship between the position of a stationary object and its movement

from place to place. All confirm the presence of stability and coherence in the infant's perceptual world. In fact, Denis-Prinzhorn (9) found that after infancy, there is even a trend toward over-constancy in size judgments.

Bower (2,3) has conducted some ingenious experiments which show that the very young child is capable of more and finer discriminations than previously suspected, and can register most of the visual information adults can, though they are able to process and use lesser amounts.

If we now consider the data on early infant perception in conjunction with Gibson's (15) work on perception of letters by means of their distinctive features, the conclusion might be irresistible that teachers could take advantage of this early development to begin teaching recognition of letters, word shapes etc. at a much younger age than is usually the case. Proponents of the academic preschool, for example, might see these studies as presenting yet further evidence that we are failing to capitalize on the young child's abilities and are wasting valuable years of potential learning in "meaningless play." Such a conclusion however would represent an inference from a limited segment of data. For one thing, we do not know precisely the operations of the perceptual mechanisms in the adult reader, much less how well such operations are matched in the perception of the young child. Most theorists in this area see the organism as inhabiting a world of "noise" from which he needs to extract such information as will reduce his uncertainty about present and future events, but they disagree as to the mechanisms which are used to this end. Moray (24) includes the following elements: mental concentration, vigilance (paying attention in the hope the event will occur), selective attention (selection of one of several messages to receive attention), search, activation (getting ready to deal with the event), and set (preparation

to respond in a certain way) (p. 6). Gibson (16) isolates three attentional processes involved in extracting invariant information from the variable flux: perceptual abstraction of information from the context, filtering irrelevant aspects of stimulation, and active exploratory search. Filtering as a perceptive mechanism for reducing noise is the object of some dispute. First proposed by Broadbent (4) and subsequently revised by him (5, 6) and by Triesman (31) to account for the fact that information supposedly filtered out may reach the subject's attention under certain circumstances, the concept has been opposed by Deutsch and Deutsch (10) who maintain that all stimuli reaching the senses are analyzed for meaning. Other writers view selective attention as testing and remembering one set of anticipations over another (18), or as the allocation of cognitive resources to a limited segment of the stimulus field. (25). Complementing his account of selective attention, Neisser presents a "fragment theory" to explain veridical perception from incomplete stimulus information; he suggests that set, familiarity, and context predispose the organism to perceive one stimulus configuration over another.

All these variables have implications for reading, and have indeed been discussed in relation to the perceptual mechanisms of the adult reader. Much of the work on perception cited in this section is relatively new and refers to the perceptual processes of adult subjects, but we do not know how well these descriptions fit the perception of the young child. Bower's work suggests that the infant's perception begins to approximate that of the adult in some respects at quite an early age, but we cannot be certain that this is true in all respects. The variables of set, familiarity, and context advanced by Neisser are likely to change with the child's developing cognitive and

linguistic competencies. Further studies of both visual and auditory perception as it functions through the preschool and elementary school years are needed.

Piaget takes a different view of the early perceptual processes we have been discussing. For him they are not truly developmental, because they do not show sequential changes with age. They are "field effects," or basic organizing forces, part of the infant's initial equipment which have survival value for the individual and persist without appreciable change throughout life. By contrast, "perceptual regulations" begin to emerge around the age of three. During the preoperational period, when decentering of both perception and thought occur, the child becomes increasingly able to reverse figure and ground, to integrate parts and wholes and to scan configurations in systematic and novel ways. Perception is centered on the dominant aspects of the visual field, which tend to be overestimated, while the remaining elements are underestimated. Perceptual strategies such as exploration, reorganization, and schematization can compensate in part for the primary defomrations, especially as these activities come more and more under the control of operational thought. From Piaget's theory of perception, it would follow then, that training in the above-mentioned perceptual activities after age 3 would be more valuable than early attention to reading per se. Elkind (11) found that black second-grade children made more progress as a result of such training than a control group which received equal time in regular reading instruction.

Piaget's theory and research thus provide a counterbalance to the premature conclusion that the young child's perception is similar to the adult's, enabling him to accomplish the same tasks albeit at a more primitive level. Work by Vurpillot (32), and some Soviet psychologists (38) support the developmental aspects of perception.

COGNITION

At the other end of the sensation-cognition continuum we find that the most comprehensive framework for investigation has been provided by Piaget's theory. The genetic evolution of intelligence has been studied in the development of the child's concepts of conservation, causality, reality, and morality. Unlike his theory of perception, Piaget's theory of intelligence has not as yet been applied directly to reading, the probable reason being that in general, the visual decoding aspects of reading have received much greater attention than the processes of comprehension. One may speculate that the application of Piagetian cognitive theory to reading may open up a highly fruitful field of inquiry. Even at the practical level it seems reasonable to suppose that an understanding of the child's cognitive development in terms of Piaget's concepts would have implications for the kinds of reading materials suitable for different age groups. It would be premature to suggest what these might be, however, until a more complete rapprochement between cognitive psychology and the psychology of reading occurs.

Furth (14) has made a broader application of Piaget's theory to reading and to education. The school, he believes, has failed in its primary mission, which is to produce citizens who are adept at solving problems. It goes without saying that our society is in desperate need of people who can solve scientific, technological, and social problems. Traditional education, with its emphasis on information gathering and respect for authority seems to be ill-equipped to fulfil this misssion. Its task should be to give children opportunities for solving problems, to show them how to find alternative paths to the same goal, and to provide them with the tools for problem-solving. Reading would be such a tool -- one of an entire arsenal. Unfortunately, as Furth sees it, the school

has chosen to elevate the tools, especially reading, to the status of a major objective. It has lost sight of the end, and has substituted a means to the goal for the goal itself. Furth maintains that a school cannot gear its resources to the teaching of reading and at the same time expect to do an adequate job of teaching problem solving. This may seem an extreme statement to some teachers, but if one sees reading instruction as inexorably tied in with the lock-step curriculum, it becomes more acceptable. Furth expands on his major thesis to suggest a variety of ways in which the teacher may institute a curriculum which emphasizes problem solving by the children.

Thus, two authors, both working within a Piagetian framework, reach different conclusions about the teaching of reading. Elkind proposes perceptual training for some (perhaps all) children as a precursor to reading instruction in the early grades, while Furth seems to view reading as a skill which might well be acquired over the elementary years as an incidental tool for problem-solving.

Interestingly enough, Rohwer (28), who specificially rejects the Piagetian notion of critical periods, has come to a similar conclusion based on different premises. In a recent article in the Harvard Educational Review entitled "Prime time for education -- early childhood or adolescence?" Rohwer cites cognitively oriented preschool programs as the only kind which have produced demonstrable long-standing gains in achievement. However, his conclusion is not, as one might expect, that more programs of this kind are needed. On the contrary he maintains that very little of present-day elementary education is relevant to life outside the school, and should be radically changed to incorporate skills of discrimination, classification, communication, and problem-solving. All these skills, including the "sacred cow" of reading, should be learned not at a particular age laid down by society, but at the time the child can acquire the

skills (and the prerequisite subskills) readily and successfully (p. 338), a conclusion not too far removed from the general position assumed by Furth.

A consideration of some recent thinking in children's cognitive development thus presents us with a situation in which the reading teacher may derive two different conclusions from the same theory, or a similar conclusion from two different theoretical standpoints.

LANGUAGE

A preoccupation with the child's perceptual and cognitive development may well lead to our placing primary emphasis on the decoding and word recognition asepcts of reading. But the work of Chomsky and others on the generative nature of language has drawn attention to the role of linguistic and information-processing skills in reading. Kolers (19), in an article entitled "Reading is only incidentally visual," cites evidence from several studies to show that good readers are faithful not to the words they see printed but to the substance of the messages the words convey. Words are not neutral graphic stimuli awaiting translation into associated phonemes, for in order to identify them, one has to know something about them, e.g. that they belong to a certain language. Moreover, there is no necessary serial sequence in the rapid reader's scanning of text. He has mastered the art of selecting clues which enable him to process and assimilate the information directly into his own cognitive structures. In Smith's (30) terms, the skilled reader goes directly to "immediate meaning", whereas the less fluent reader resorts to the "lower route" of "mediated meaning", identification". The implication is that reading instruction should move away somewhat from emphasis on visual recognition, and concentrate on search for clues and information-extracting skills, a suggestion which is congruent with Rohwer's idea of postponing reading until it is relevant to life tasks.

On the other hand, theories of language acquisition which were developed in the 1950s and 60s tended to emphasize the early formation of a complete grammar. Thus as late as 1966, McNeill (21) was writing: "The fundamental problem to which we address ourselves is the simple fact that language acquisition occurs in a surprisingly short time. Grammatical speech does not begin before 1 1/2 years of age; yet as far as we can tell, the basic process is complete by 3 1/2 years" (p. 15). Lenneberg (20) also sees the period from 2-4 years as critical for language learning, (although he does see primary language acquisition continuing until adolescence). From this fact one might be tempted to draw either of two conclusions. The first would be that the process of language acquisition is largely irrelevant to reading, since it is virtually complete before reading begins (35). The second would again emphasize the importance of early reading activity to capitalize on the rapid growth of language.

More recent work, while not discounting the importance of the early period, has restored some emphasis to the continued learning of grammar throughout the elementary school years. Numerous investigations have shown that significant language development occurs after age six. C. Chomsky (7), for example, points out that several grammatical developments occur after age 6, a most striking example being growth in the use of pronouns. O'Donnell, Griffin, and Norris (26) found acquisition of new transformations between grades 3 to 5 and 5 to 7, while Menyuk (22) found examples of more complicated structures as age increased.

Hence inferences about reading based on the earlier position of the linguists, are no longer tenable in the light of this more recent research.

Another aspect of language development which has current salience for reading practice is the issue of dialect. Many linguists appear to be discarding

the notion of language deficit which was in vogue about five years ago. Rather they see the inner-city child as having a language system which is well developed both syntactically and semantically, which has some overlaps with standard English, but also many differences. Since most school texts and other reading materials are in standard English, the issue becomes that of finding the most effective ways of introducing the dialect speaker to these standard materials. The various alternatives have been discussed by Wolfram (37). If extant materials are retained, one may teach standard English, prior to reading, and the child may be asked to render these materials in standard English or in dialect form. The latter requires that the teacher be thoroughly familiar with the dialect in order to distinguish between the dialect rendition and genuine reading errors. If materials are revised, one may eliminate all features which may cause problems for the lower-class speaker (e.g. the possessive 's), or one may construct beginning materials in dialect form with gradual transition to standard text. Wolfram concludes that, in spite of the outspoken rejection of dialect readers by some member of the black community, "the magnitude of the reading problem suggests that experiments must be made, with alternatives which may involve the potential changing of materials and curricula" (p. 32). Another possible approach is to mix standard- and dialect-speaking children in the preschool to permit the latter to gain an understanding of standard English even though they do not use it in speech. While this may be a preferable alternative, it is probably not feasible on a large scale at this time.

On this particular issue, the educator may find that, however well-grounded in linguistic theory his inferences may be, he cannot translate them into practice without taking cognizance of the social and political context in which the school operates.

MOTIVATION

Unfortunately there is no technical sense of "affection" corresponding to use of the term "cognition": If there were, it would more accurately describe the complex of factors which might be considered under the present rubric.

The study of affective factors and their relationship to cognitive development has undergone considerable change in the last decade. In one sense with the current disillusionment with formal education, motivational aspects have come into prominence in such forms as humanistic education, sensitivity training, alternate universities, etc. On the other hand, the boom in cognitive psychology has deflected much research energy from the study of nonintellectual factors. If one wanted to trace the development of this movement away from the affective toward the cognitive, no doubt White's (36) classic paper in which he elevated competence to the status of a primary drive would stand as a landmark. But the major source of the change is probably to be found in the current absorption with Piaget's cognitive theory. Piaget does not disregard the motivational aspects of thought; on the contrary he seems to consider motivation as an inherent and inseparable dimension of thought, in the sense that it is part of the on-going process of intellectual activity. Perhaps the perennial difficulty of measurement in the affective domain is also partly responsible. Whatever the reasons, the fact remains that research on nonintellectual factors in learning seems to have suffered a relative decline. It is interesting to note that the 600-page report of the Literature Search project (8) which addressed itself to every facet of reading made only passing reference to the entire affective domain -- a gross omission in my estimation.*

*The one exception being the paper by Entwisle, referred to below.

I believe that there is a dimension here which is perhaps more difficult to take hold of, and therefore less rewarding in immediate payoff, but which nonetheless demands continuing attention. I have reviewed the literature on affective factors and reading elsewhere (1). Although it is plentiful, one missess the connecting thread of a good theory to make sense of the plethora of inconclusive and contradictory data. Perhaps such a theory, when we find it, will address itself to the changing motivations and how they affect learning at each age of the lifespan. Meanwhile, it is to be hoped that we will not lose sight of this important domain of inquiry.

Such a theory would need to explain the effects on learning of cultural and social class differences. These have been well-documented in relation to language and reading by Entwisle (12), and include such variables as control beliefs (knowledge of one's ability to manipulate the environment to meet one's needs), self-confidence, inflexible family role learnings, and the like. Entwisle concludes from her review that "we can only meaningfully teach reading to lower class children when it begins to make sense of their lives" (p. 145).

CONCLUSION

In this paper, I have discussed some recent literature in perception, cognition, language, and motivation as they pertain to reading. Such a review must of necessity be highly restricted in each area, but I chose to touch on all four areas deliberately, to make the point that the reading teacher, as well as the professor of education, needs not only to be cognizant of what is happening in these (and other) fields, but to keep some perspective among them. If we fail to keep this balance, we are at the mercy of temporary fads which offer panaceas on the basis of limited data.

If education is to be a science, it must progress in the same way other sciences do, by acquiring a systematic body of knowledge, rather than by chasing every fad which claims to have some scientific basis. Education is particularly vulnerable to faddism, because its sources of input are more numerous, but at the same time disparate. Consequently, educators need to be in one sense more open to new developments, and yet more defensive. They must scrutinize each innovation for its scientific underpinnings, and determine whether these conflict with what is known in other fields.

We lost the "whole child" in the 1950s, and are rebuilding him scientifically from our accumulated wisdom. Putting him together again promises to be a long and arduous, but rewarding process.

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